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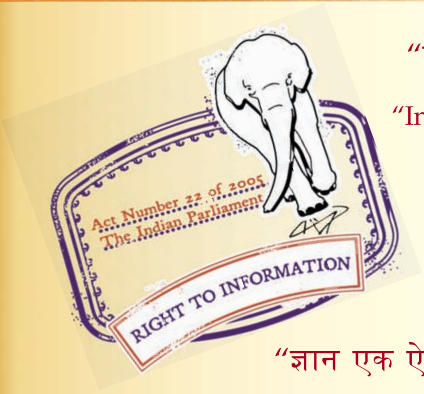

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Indian Standard

SPECIFICATION FOR FARM MILK COOLING TANKS

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4

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SPECIFICATION FOR FARM MILK COOLING TANKS

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(*Continued on page* 16)

c) Capacity of the tank; and

d) Refrigerating capacity for condensing unit shall be stated in kcal/h at a saturated suction temperature designated by the manufacturer.

11.1.1 Each tank may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

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AMENDMENT NO. 2 JUNE 1992
TO
IS 3661 : 1966 SPECIFICATION FOR FARM MILK COOLING TANKS

(*Page* 11, *clause* **6.2.2**) — Substitute 'water' *for* 'milk' wherever it appears in the clause.

(FADC 19)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SPECIFICATION FOR FARM MILK COOLING TANKS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 3 August 1966, after the draft finalized by the Dairy Industry Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 The farm milk cooling tank is intended to cool and store milk. For the purpose of this standard it has been assumed that the farm milk cooling tank will be subjected to an ambient temperature of 43°C.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard lays down requirements of design, construction and performance for farm milk cooling tanks in which bulk milk is cooled and stored. It includes the tanks which are intended for use at a place where electricity is available from mains supply or from a generating set.

2. CAPACITIES

2.1 Each farm milk tank shall be designated by its rated capacity. This shall be the volume of milk which the tank is designed to operate and at which it shall be tested.

2.1.1 The tanks should be designed to the rated capacities of 500, 1 000 and 2 000 litres.

2.1.2 Actual capacities shall be determined with the tank filled to a level of 60 mm below the top edge of the inner vessel and shall agree with the corresponding nominal capacity within $^{+5}_{-0}$ percent.

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*Rules for rounding off numerical values (*revised*).

3. MATERIAL

3.1 All component parts the surfaces of which come into contact with milk, shall be made of stainless steel conforming to designation 07Cr19Ni9 in Table XXXIV of Schedule V of IS : 1570-1961*.

3.2 All other parts surfaces of which do not come into contact with the milk, shall be made of a material which is either corrosion-resistant or is rendered corrosion-resistant by a suitable preservative treatment on a prepared rust-free surface.

4. TANK

4.1 The tank shall be so designed that all surfaces in contact with milk are readily accessible either in their position or after dismantling so as to permit thorough cleaning.

4.2 The height from the underside of the supporting structure (chassis) to the brim of the inner vessel shall not exceed 1 200 mm.

4.3 Inner Vessel

4.3.1 All joints shall be welded, any filler rod used being suitable for the parent metal. All welds shall be ground smooth and free from crevices. All milk contact metallic surfaces of the inner vessel and its attachments shall be brought to a finish not less than dull polished.

4.3.2 All welded joints shall be free from porosity and brittleness. The joints shall be well-dressed and finished smooth, particularly those joints which come into contact with milk.

4.3.3 The inner vessel shall be provided with an upstand not less than 15 mm high. The breast piece round the inner vessel shall slope downwards to the outside of the tank with a gradient of not less than 1 in 20.

4.3.4 The breast piece shall be of stainless steel conforming to the designation 07Cr19Ni9 in Table XXXIV of Schedule V of IS : 1570-1961*.

4.3.5 Any permanent attachment to the inner vessel shall be welded with fillet radii not less than 6 mm.

4.3.6 Where separate from the sheathing, the breast piece shall be turned downwards to overlap the sheathing by not less than 15 mm.

4.3.7 All parts of the inner vessel shall drain directly to the outlet.

4.3.7.1 In vertical cylindrical tanks, the slope of the chord (or chords) from the internal corner at the bottom of the vertical sides to the outlet well in a diametral plane shall be not less than 1 in 15 to the horizontal.

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*Schedules for wrought steels for general engineering purposes.

4.3.7.2 Rectangular tanks with shallow V-bottom shall have a longitudinal fall not less than 1 in 25 combined with a transverse fall to the longitudinal axis also not less than 1 in 25 to the horizontal.

4.3.7.3 Rectangular tanks with semi-cylindrical or semi-eliptical bottoms shall have a longitudinal fall not less than 1 in 25 to the horizontal.

4.3.7.4 Rectangular tanks with hopper bottoms shall have falls to the outlet of not less than 1 in 25 to the horizontal at any point.

4.3.8 Internal corners formed round the bottom of the inner vessel and outlet well shall be of not less than 25 mm in radius. Other internal corners shall be not less than 15 mm in radius.

4.4 Thermal Insulation

4.4.1 The sides, ends and bottom of the tanks shall be insulated to reduce stray heat gains.

4.4.2 The amount of insulation applied shall be such that the rise in the mean temperature of the content of a full tank initially at 4°C over a period of 8 hours in an ambient temperature of 43°C shall not exceed 2°C.

4.4.3 The insulating medium employed shall be non-hygroscopic, non-settling and shall not be liable to displacement during transit or service.

4.4.4 An effective vapour barrier shall seal the external surfaces of the insulating medium and prevent the ingress of moisture.

4.5 External Finish

4.5.1 The thermal insulation shall be provided with an outer casing made of mild steel painted or otherwise made rust-proof or of stainless steel to exclude water from the insulation and to provide a smooth and hygienic external surface.

4.5.2 Vertical joints in the outer casing shall be sealed by lapping. Cover strips, where used, shall be overlapped by the breast piece at their upper ends by not less than 10 mm.

4.5.3 Any part of the outer casing which is not vertical shall drain effectively.

4.6 Inspection Openings in Breast Piece and Sheathing

4.6.1 Inspection panels or apertures of sufficient size shall be provided to facilitate:

a) inspection of the ice-bank coil when such a coil is provided, and

b) access to thermometer sensitive elements, thermostats, ice-bank controllers or other components for inspection or replacement.

4.6.2 Inspection opening in nearly horizontal surfaces in breast piece and sheathing shall be provided with:

a) upstands of not less than 10 mm,

b) covers with downturned edges to overlap the upstands by not less than 5 mm, and

c) covers with handles or lifting knobs.

4.6.3 Inspection openings in vertical surfaces in the sheathing shall be provided with covers which:

a) are overlapped on the upper edge by 15 mm,

b) overlap all edges except the upper by 15 mm, and

c) may be positively retained in position.

4.7 Tank Supports

4.7.1 The tank shall be provided with adjustable or rigid supports, the number and position of which shall be adequate to carry the structure.

4.7.2 When the tank is installed these supports shall be readily accessible, and shall be positioned not more than 350 mm from the nearest tank wall, unless the latter is curved in the vertical plane to give access to the underside of the tank.

4.8 Bridge

4.8.1 Any bridge or bracket required to be supported from the inner vessel shall be welded to the top of the upstand and shall not exceed a width of 700 mm.

4.8.2 The sum of dimensions of the remaining clear openings into the inner vessel shall not be less than 600 mm measured along the length or diameter of the inner vessel.

4.8.3 Bridges covering one end or segment of a tank shall be inclined at a minimum of 1 in 10 to the horizontal.

4.8.4 All bridges and apertures therein shall be provided with upstanding edges not less than 10 mm high, except that apertures smaller than 75 mm in diameter may have upstands not less 5 mm high. Surfaces shall be sloped to discharge any accumulation of moisture clear of the open tank top.

4.8.5 Any covers shall have downturned edges to overlap the upstands by not less than 5 mm.

4.8.6 Any permanent attachment to the bridge shall be welded with fillet radii of not less than 6 mm.

4.9 Main Covers for Inner Vessel

4.9.1 One or more close fitting covers, so designed as to lift off when desired, shall be provided for openings in the top of the tank. Covers shall be sloped to the outside to provide free drainage for any moisture and shall be turned down at the outer edge to overlap the upstand.

4.9.2 Covers shall be provided with means to support them in the open position. Covers shall allow easy inspection and sampling of the milk and operation of the outlet control and dipstick (where provided).

4.9.3 Covers shall be of stainless steel conforming to designation 07Cr19Ni9 in Table XXXIV of Schedule V of IS : 1570-1961* or aluminium alloy sheets conforming to IS : 737-1955†.

4.9.4 All apertures shall be provided with upstanding edges, and separate removable covers shall be provided to fit over the apertures. The upstand shall be not less than 5 mm for apertures up to 75 mm in diameter and 10 mm for all others. Downturned edges of aperture cover shall be not less than 6 mm.

4.9.5 Where covers are intended to support strainers or hoppers for milk reception, the design shall be such that the whole of the body of the strainer or hopper is at all times completely above the level of the milk when the tank is filled to a level 30 mm below the lowest point on the upstand of the inner vessel, and the covers shall have sufficient strength to support the additional loads involved.

4.9.6 All handles attached to covers shall be external and unless of integral construction shall be attached by welding to provide smooth hygienic surfaces.

4.9.7 Internal radii of covers shall not be less than 6 mm.

5. TANK FITTINGS

5.1 Outlet

5.1.1 The outlet orifice shall be of 50 mm nominal diameter, substantially horizontal and circular, and shall be situated in a well formed at the lowest point of the inner vessel. The centre of the orifice shall be not more than 100 mm distant from the wall of the inner vessel for tanks of shapes other than vertical cylindrical pattern and not more than 500 mm for tanks of vertical cylindrical pattern.

5.1.2 The well shall be not less than 25 mm deep at the outlet orifice. If circular, the diameter shall not be less than 100 mm nor more than

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*Schedules for wrought steels for general engineering purposes.

†Specification for wrought aluminium and aluminium alloys, sheet and strip (for general engineering purposes) (Since revised).

200 mm. If elongated, the length and width each shall not be less than 100 mm nor more than 200 mm.

5.1.3 The outlet pipe shall be 50 mm diameter stainless steel pipe (*see* IS : 3382-1965*) and shall be welded to the inner vessel. If not of one piece, the pipe shall have not more than one joint situated externally and in an accessible position. The joint shall be of clean-in-place type.

5.1.4 The bend in the outlet pipe shall have a mean radius of not less than 55 mm.

5.1.5 The outer end of the outlet pipe shall emerge from the casing substantially horizontally.

5.1.6 In all cases the outlet shall terminate in a 50-mm ring joint male end and shall be provided with a blank cap and nut.

5.1.7 The outlet pipe shall be as short as is reasonably practicable. Clearance shall be provided to permit the use of a union nut spanner.

5.2 Outlet Control

5.2.1 The outlet shall be provided with a control consisting either of a hygienic cock or of a hygienic plug and rod device.

5.2.2 The arrangement shall be such that:

a) the plug does not need to be clamped in position in order to seal,
b) means are provided for retaining the plug and rod in the open position clear of the milk agitator,
c) there shall be no detachable components capable of passing down the outlet of the tank.

5.3 Agitator

5.3.1 The tank shall be provided with a stainless steel agitator designed to promote effective heat transfer and to effect thorough mixing of the milk without churning the milk fat, or spillage of milk at any filling level up to 30 mm below the lowest point on the upstand of the inner vessel.

5.3.2 All welds on agitator blades and shafts shall have fillet radii of not less than 6 mm. All surfaces of the blades and shafts shall be readily accessible for cleaning. Surfaces other than vertical shall be avoided where possible.

5.3.3 The agitator shaft shall incorporate a coupling above the maximum milk level, whereby the blade assembly may be removed from the tank for cleaning.

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*Specification for stainless steel milk pipes and fittings.

5.3.4 In case of tanks where the agitator drive unit is mounted on the inner vessel cover, the blade of agitator shall become readily accessible when the cover is raised.

5.3.5 The agitator shaft shall be provided with a retractable deflector between the drive units and the bridge or cover over the inner vessel.

5.3.6 The deflector shall be:

a) of synthetic rubber or other suitable material,
b) of a close fit on the shaft, and
c) so designed that in its lower position the aperture round the shaft is closed.

5.3.7 The design of the shaft, deflector and aperture shall be such that these components are readily accessible for cleaning above and below the bridge of cover.

5.3.8 The design of the agitator shall be such that it shall operate effectively when the tank contains 15 percent or more of its rated capacity.

5.3.9 The performance of the agitator shall be such as to produce throughout the content of the tank filled to 100 percent rated capacity a butterfat distribution uniform to within ±0·05 of butterfat percentage (*see* IS : 1224-1958*) after operation for not more than four minutes in milk that has been cooled to 4°C and has then remained undisturbed for six hours.

5.4 Milk Thermometer

5.4.1 The tank shall be provided with a vertical immersed-stem liquid-charged dial thermometer having external stem surface of polished stainless steel.

5.4.2 The temperature-sensitive portion of the thermometer shall be so disposed that accurate indications are given when the tank contains 15 percent or more of its nominal capacity.

5.4.3 The diameter of the dial shall not be less than 100 mm and the scale shall extend from not more than 1°C to not less than 40°C. The scale shall have not more than range 10 deg per 25 mm of scale length.

5.4.4 The indicating head of the instrument shall be robust and sealed to prevent ingress of dust or moisture.

5.5 Milk Thermostat

5.5.1 The tank shall be provided with a vertical immersed-stem, liquid-charged thermostat for control of the cooling system, having external stem surfaces of polished stainless steel.

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*Determination of fat in whole milk, evaporated (unsweetened) milk, separated milk, skim milk, buttermilk and cream by the Gerber method.

5.5.2 The temperature-sensitive portion of the thermostat shall be so disposed that the instrument operates correctly when the tank contains 15 percent or more of its nominal capacity.

5.5.3 The thermostat contacts shall open at a milk temperature of 4°C (with tolerance +0°C and −2°C) in the ambient temperature as to ensure that the temperature of any part of the milk does not exceed 9°C.

5.5.4 The operating head shall be robust and sealed to prevent the ingress of dust or moisture.

5.6 Combined Milk Thermometer and Thermostat — The tank shall be provided either with a separate milk thermometer and milk thermostat as described in **5.4** and **5.5** or with a combined milk thermometer and thermostat.

5.7 Ice-Bank Controller — Where used, ice-building refrigeration systems shall be provided with automatic means for controlling the ice formation. This control shall be of such a type and be so placed that under normal operating conditions to prevent block freezing and exertion of pressure into the inner vessel. The controller shall operate satisfactorily within the range of —1°C to +40°C in the ambient temperature.

5.8 Dip-Stick

5.8.1 Each tank shall be provided with a dip-stick and dip-stick holder, and a datum line showing the position of the dip-stick relative to the tank wall shall be inscribed on the tank wall.

5.8.2 The length of the dip-stick shall be such that readings may be taken up to 10 percent of nominal tank capacity.

5.8.3 The surface finish of the graduated face shall be such that an accurate indication of level is given when used with water.

5.9 Opening for Chemical Cleaning — The tank shall be provided with one or more chemical cleaning devices of stainless steel on the top of the tank so as to facilitate thorough cleaning of the tank.

6. REFRIGERATION

6.1 The refrigeration system may be:

a) of the directly refrigerated type, or

b) of the chilled water type.

6.2 Duty

6.2.1 Tanks designed for cooling and storage shall have refrigerating equipment of capacity sufficient to perform the following daily duty, all in an ambient temperature of 43°C with condenser:

a) Cool 100 percent of nominal tank capacity from 38°C to 4°C;

b) Eliminate all stray heat gains; and

c) Eliminate heat input from wash water, equivalent to the addition to the cold, empty tank, of 7½ percent of nominal capacity at a temperature of 43°C when brushed around for 15 minutes.

6.2.2 Tanks designed for cooling and storage shall have the following milk cooling performance in ambient temperature of 43°C:

a) The mean temperature of a volume of milk equal to 60 percent of the capacity of the tank will be continuously reduced from 38°C to 10°C in 2½ hours, and from 38°C to 4°C in 3½ hours, the tank initially containing 40 percent of its capacity at a mean temperature of 4°C and then receiving the 60 percent at a uniform rate over 1½ hours.

b) The mean temperature of a volume of milk equal to 40 percent of the capacity of the tank will be continuously reduced from 38°C to 10°C in 2½ hours, and from 38°C to 4°C in 3½ hours, the vessel initially having been empty for 2 hours following washing with water at 43°C equivalent to 7½ percent of the capacity of the tank when brushed around for 15 minutes.

c) The mean temperature of the milk having been reduced to 4°C or less, the heat gain by the contents of the vessel which may be any quantity from 10 percent to tank capacity, is limited by the operation of the cooling equipment or by virtue of the insulating properties of the tank or by both so that the mean temperature of the milk will not exceed 4°C nor will the surface temperature of the milk exceed 6°C at any time.

NOTE — The periods of time mentioned above include the filling time.

6.2.3 In farm tanks incorporating an ice-bank system, the inner vessel shall be surrounded with an external jacket on the body and the bottom. This jacket shall house the ice-building coil (evaporator) and the space shall be sufficient to build requisite quantity of ice to meet the requirements of performance given in **6.2.1** and **6.2.2**. The jacket also shall have a water inlet, water outlet, overflow pipe or air distributor pipe with connections to the air supply system, that is, blower of compressor. In a farm tank constructed for cooling milk by direct expansion, the jacket shall surround the entire bottom of the vessel and such part of the body as is required to provide the necessary heat transfer to conform to the performance requirement specified in **6.2.1** and **6.2.2**.

6.3 Prevention of Freezing of Milk — Tanks shall be so constructed and controlled that no freezing of milk takes place at any time.

6.4 Control of Milk Temperature — The milk temperature control system shall:

a) start and stop the main milk cooling operation automatically;
b) operate at any level of filling down to 10 percent of rated capacity;
c) terminate the main milk cooling operation within the range 4°C to 2°C at any milk quantity over 20 percent at ambient temperatures between −5°C and +43°C;
d) prevent the milk temperature during storage in 43°C ambient temperature from reaching 9°C at any point, above 10 percent of rated capacity. For this purpose overnight storage shall be assumed to be 12 hours and day time storage 6 hours; and
e) prevent the mean milk temperature from exceeding 4°C during storage under the conditions laid down in (d).

6.5 Construction

6.5.1 In all cases of direct expansion evaporators, the connection of service pipes to the refrigerating jacket shall be by compression joint or screwed joint as appropriate to a tail, half union or socket welded into the jacket. Brazed, silver soldered or soldered joints shall not be used.

6.5.2 Chilled water tanks shall be provided with an overflow and a drain outlet not less than 25 mm in diameter. The outlet shall be designed to prevent water from running provided with screw type plug along the underside of the tank during emptying.

6.6 Pressure Testing

6.6.1 Evaporators to be charged with dichloridifluromethane or methyl chloride shall be tested with air or gas at a pressure of 14 kg/cm^2. In cases of other refrigerants the test pressure shall not be less than the vapour pressure at 65°C.

6.6.2 Chilled water tanks and jackets shall be tested for leakage.

6.6.3 After pressure testing the evaporator systems shall be cleaned, dried and sealed. Chilled water shall be drained, cleaned, and the open ends plugged.

7. CONTROL SYSTEM

7.1 The control system shall provide automatic operation of the milk cooling system and condensing unit if the tank is of the ice-bank type.

7.2 A clearly marked duty selection switch shall be provided to give 'AUTOMATIC' and 'OFF' positions for the milk cooling system power supply.

7.3 For directly-refrigerated tanks the 'AUTOMATIC' position shall provide thermostatic control and interlocking of the compressor and milk agitator motors so that failure of either shall shut down the other.

7.4 For chilled-water tanks the 'AUTOMATIC' position shall provide control of the chilled water circulation and milk agitator. Interlocking shall be provided to shut down the milk agitator should the chilled water agitation or circulation pumps fail.

7.5 Over-riding manual control switches shall be provided to shortcircuit milk temperature control systems and a neon lamp shall indicate when this switch is in use.

7.6 A timing switch shall be provided so that the milk agitator may be turned on by the tanker operator, and be maintained in operation automatically for a minimum of 2 minutes. This timing switch shall be capable of operation when the duty selection switch is in the 'OFF' position.

8. ELECTRICAL EQUIPMENT

8.1 General — The electrical equipment shall be of adequate capacity, and shall be properly installed.

8.2 Motors

8.2.1 Compressor motors shall generally be of the totally enclosed fan cooled type except that when condensing units are installed in a dry and substantially dustproof location, the compressor motors may be of the dripproof protected type.

8.2.2 All exposed motors shall be of the totally enclosed type.

8.3 Starters

8.3.1 Starters may be individually mounted or contained in a unit panel.

8.3.2 In either event, starters shall be amply proportioned and proper protection shall be afforded against excess current.

8.3.3 Starters shall be enclosed in a strong metal case effectively sealed against ingress of dust or moisture.

8.4 Wiring

8.4.1 All permanent wiring installed on the tank or associated units shall be carried out using PVC cable in heavy gauge, screwed galvanized steel conduit or plastic conduit, or in mineral-insulated copper-sheathed cable.

8.4.2 Flexible connections shall be made only to items normally movable in service. Such flexibles shall be PVC insulated cable not less than 24/0·20 mm in size [*see* IS : 694 (Part 1)-1964*] and earth continuity conductors shall be provided. Flexibles shall be protected by armoured PVC flexible conduit properly fastened by watertight glands at each end.

8.5 Earthing

8.5.1 The chassis, framework and the fixed parts of the metal casing of the tanks where used, shall be provided with two separate earthing terminals. These terminals shall be provided over and above all other means provided for securing metallic enclosures (armour or other metallic coverings) of current carrying cables.

8.5.2 The earthing terminals shall be readily accessible and so placed that the earth connection of the tanks is maintained when the cover or any other movable part is removed.

8.5.3 The earthing terminals shall be of adequate size, be protected against corrosion and shall be metallically clean. Under no circumstances shall a movable part of the enclosure be insulated from the part carrying the earthing terminal when the movable part is in place.

8.5.4 The earthing terminal shall be identified by means of the sign ' ⏚ ' marked in a legible and indelible manner on or adjacent to the terminals.

NOTE — For details of earthing, *see* IS : 3043-1966†.

9. STERILIZATION

9.1 Tanks may be sterilized by hot water, steam or by hypochlorite sterilization (cold sterilization) depending upon the manufacturers operating instructions. Manufacturers shall give directions on the cleaning procedure to be used in the operating instructions issued with the tank.

10. FABRICATION

10.1 The farm milk cooling tank shall be fabricated in such a manner as to conform to the requirements laid down in the standard (**2** to **9**). The design of a typical farm milk cooling tank is shown in Fig. 1.

11. MARKING

11.1 The tank shall be marked legibly and permanently with the following particulars:

a) Manufacturer's name or trade-mark or initials;
b) Manufacturer's identification;

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*Specification for PVC insulated cables (for voltage up to 1 100 V): Part I With copper conductor (*revised*).

†Code of practice for earthing (*under print*).

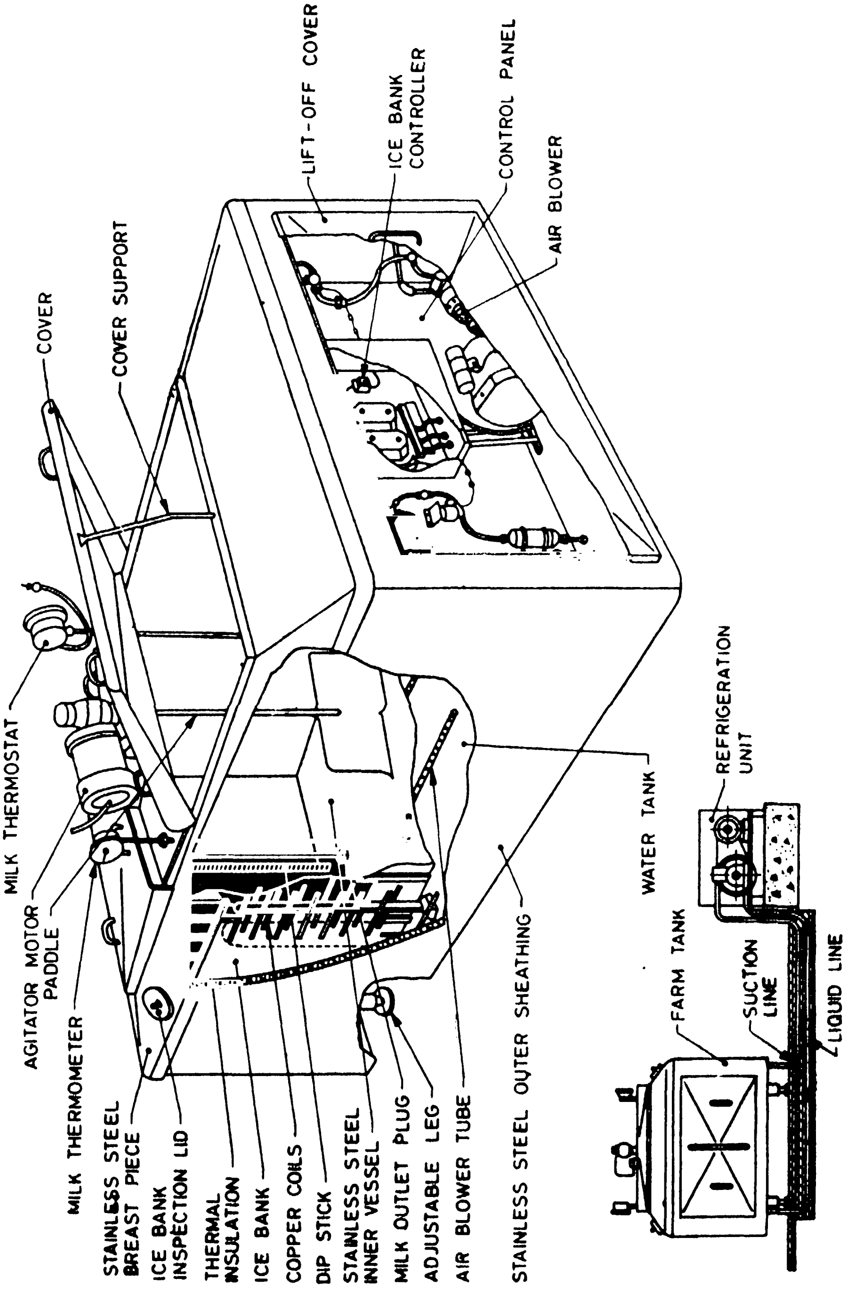

FIG. 1 TYPICAL FARM MILK COOLING TANK

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